THE APPLICATION OF THE ECONOMIC THEORY OF THE FIRM TO FARM MANAGEMENT RESEARCH WITH PARTICULAR REFERENCE TO RECENT ADVANCES IN DYNAMIC ECONOMICS

BY

DONALD BIRTALL WILLIAMS

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AN ABSTRACT OF A THESIS

SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF DOCTOR OF PHILOSOPHY IN AGRICULTURAL ECONOMICS IN THE GRADUATE COLLEGE OF THE UNIVERSITY OF ILLINOIS, 1950

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R. UNIV. BIBLIOTHEEK LEIDEN

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INTRODUCTION

There is need to remain constantly informed of recent advances in those sciences on which the applied science of farm management depends. Outmoded doctrines and analyses based on them can then be revised and new advances can be incorporated in the body of principles which constitute farm management. In particular, recent advances in dynamic economics provide more guidance to realistic interpretation of practical problems in farm management.

This general theme is developed in

1. a historical survey of farm management,
2. an analytical discussion of economic concepts of importance in farm management, with particular reference to the economic theory of the firm,
3. a field survey which is used to suggest how recent advances in dynamic economics can be applied in the interpretation of research data relating to farm management problems.

HISTORICAL DEVELOPMENT OF FARM MANAGEMENT

The historical review reveals the influence of other sciences, economics and agriculture in particular, in the development of farm management. Fact collection and statistical methods used in farm management by the early workers were based upon scientific methods developed in agricultural rather than social sciences. Later, the influence of the social sciences became more apparent, and methodological issues were brought to the focus of attention as a result of the more thorough economic training of workers in the field of farm management.

The theory of the firm used to establish farm management principles is based on the enchanting assumption of perfect competition with little or no account being taken of clock time. Empirical studies early in the development of the science drew attention to the unreality of assuming unlimited flexibility of the physical and financial operation of the firm. While long term economic analysis may be used to describe the aggregate response of a group of firms, the temptation to use it as a basis for interpreting individual firm responses should be resisted. The assumption of flexibility in capital supplies is one which limits the usefulness of analyses whch depend upon it in interpreting farm management data. Capital rationing exists in practice. Hence the validity of comparisons between firms depends on their comparable status with regard to the capital invested in the firm and the availability of additional capital supplies to the farmer. Farm management analyses, and extension recommendations based upon them, need to take account of this difference in financial organization between farms, and of the ability of farm operators to make adjustments in the capital structure of their farms. Firms which have different supplies of capital available may react differently to uncertain situations in which risks are involved in adopting a practice based on farm management research findings. A farming system adopted because of limited capital funds should be analyzed in this light. The results obtained from a farm system so organized can only be compared with results from farms whose production programs have been similarly influenced by an inability to secure capital to enable production to be increased so as to approach the static concept of the intensive margin.

Some of the assumptions on which farm cost analyses are based are those static economic theories which tend to consider all costs to be comparable when expressed in money terms, irrespective of the nature of the physical production service which this money cost represents. Many individual farm cost studies have been used to help analyze the business organization of farms under similar circumstances. The limitations imposed by arbitrary assumptions based on averages of groups of farmers are evident when the continued existence of a firm through time is incorporated in the analysis. In this case, the physical production services are found to differ

with regard to their flexibility and in the proportion of cash costs involved in their use. Such differences influence farm management efficiency. The different kinds of production services in use on farms impose limitations on the adjustments which can be made to reduce the very money costs which are used to measure the efficiency of production on each particular farm.

In the past, farm classifications have been used to establish patterns of relationships between farm efficiency factors and incomes on farms classified into groups which are considered to be comparable. If valuations established by costing procedures are accepted and if the variables with which variations in income are associated are correctly identified, there is no inherent error in this method. Recent advances in dynamic economics suggest that some of the variables concerned may not yet have been identified in concise terms. Further, the influence of these variables which are not identified is confounded with the influence of other variables to which differences in income are now so often attributed. The effects of uncertainty may thus be confounded with the effects of the variables which the analysis purports to describe.

DYNAMIC ECONOMIC THEORY AND FARM MANAGEMENT

The presentation of a formal economic theory designed to describe dynamic situations is an important development in the history of farm management. Problem situations in farm management can now be interpreted in terms of a body of economic principles which refer to situations in which entrepreneurial decisions are made with the knowledge that the outcome of a venture is not known with certainty. It is to this body of principles and their potential usefulness in farm management research that attention is directed in this study.

It is argued that the interpretation of farm management situations can be made more realistic if the effects of the farmer's attitude toward the alternative uncertain situations which may develop in the future can be superimposed on, or used to modify, the analysis based on static economics which is now commonly used.

Dynamic economics refers to those phases of economic theory in which every quantity must be dated. Dynamic economic theory developed since the publication of J. R. Hicks' *Value and Capital*

has not yet been able to provide a specific description of economic systems. While concepts have been clarified and the importance of the position of a firm in relation to time has been established, further progress awaits the collection of empirical evidence which will provide a basis for development of more realistic economic models.

While outlook data serve a useful purpose, these more recent developments do advance beyond the stage where the importance of outlook data is recognized. They seek to show how more realistic interpretation can be made of the decisions which an entrepreneur makes in situations which may have one of several alternative outcomes. Outlook data guide the farmer's thoughts toward a most probable price in the future. They do not remove the need on the part of the farmer to consider that the price may be at one of several different levels, and that his actions need to be adapted to take as nearly full advantage as possible of the best outcome while conserving his opportunities to minimize his losses should the worst outcome occur. Individual farmers may be expected to differ in the relative importance which they attach to preparedness for the best as well as the worst outcome. They may also differ in the likelihood which they attach to those respective outcomes. It may be expected therefore, that farmers would respond differently to the same set of possible outcomes. Differences in the present position of farms may be attributable to such differences in response in times past. Differences in attitudes toward risk on the part of farmers may alter their willingness to adopt any practice which extension agents recommend. On such considerations as these depends the importance of dynamic economics in farm management. Its incorporation will aid in the interpretation of farm management research data and will also facilitate the acceptance by farmers of recommendations based on such data.

A FIELD SURVEY OF THE NATURE OF EXPECTATIONS AND FARMERS' UNCERTAINTY PREFERENCE

The process of integration of dynamic theories into farm management will depend on the collection of empirical data relating to this aspect of farm management. In this study attention is confined to the nature of expectations developed in the minds of farmers and to differences between farmers in their preference

relating to choices between sure and uncertain alternatives. This is a necessary step in the later development of an explanation of the effects of these expectations as factors motivating the acts of farmers.

Empirical data relating to expectations formed by farmers were collected by means of a field survey. This survey was guided by theories relating to dynamic economics, by previous studies of a similar nature by other workers and by a preliminary survey among members of the Illinois Farm Bureau Farm Management Service designed to test a draft of the questionnaire. The survey was conducted in Type of Farming Area 4a, the cash grain area of Illinois; and 161 farmers were interviewed. The sampling method used was an area cluster method, the design consisting of twenty clusters of eight farms each.

The price expectations expressed by farmers were not all expressed as a single value. Farmers were asked for a range of expected prices above and below a single most probable price. Some farmers indicated a most likely price of (say) $1.00 per bushel for corn in Chicago in December, 1950, and then expressed their estimate of the most likely price range to be from $1.00 to $1.25. The tendency for some farmers to express expected prices in this way suggests a bimodal distribution of the probabilities of the different expected prices, with the most probable of the two modes expressed as the expected price. The nature of expectations for corn is indicated in Table 1.

TABLE 1

Corn Price Expectations: Nature of Expectations

Nature of Expectations	Number of farmers	Example of expected price	
		Single price	Range of expectations
Single value		$	$
—no range	7	1.10	——
—at top of range	21	1.10	.90-1.10
—mid range	87	1.10	.90-1.25
—at bottom of range	19	1.10	1.10-1.35
Range only	24	——	.90-1.25
Expressed in relation to support price	1	——	15c less than support price
No cardinal expectation	2	——	
Total	161		

For those farmers expressing single value expectations, the modal price expectation for corn on December 1, 1950, in Chicago was $1.00 per bushel; the modal price per bushel expected for soybeans was $2.00; for hogs the price per hundredweight expected was a bimodal distribution at the $14.00 and $15.00 levels; the modal price expected for good to choice beef cattle was $25.00 per hundredweight. A tendency for farmers to round off stated expectations to the nearest quarter of a dollar was very evident in the case of corn and soybeans.

An attempt was made to determine whether the expectations by individual farmers in relation to the different prices were related. A linear correlation of the expectations of individual farmers showed that the correlations were so low as to suggest that farmers formed their expectations of prices in specific terms relating to each commodity, rather than in terms of a general overall increase or decrease in price levels.

TABLE 2

Correlation Between Prices Expected by Individual Farmers for Four Commodities

Commodities	Number of farmers	Correlation coefficient *	Standard error of correlation coefficient
Corn-hogs	100	0.2418	0.0941
Corn-beef cattle	69	0.0000	——
Corn-soybeans	108	0.1988	0.0924
Soybeans-beef cattle	64	0.2922	0.1143
Soybeans-hogs	89	0.2628	0.0987
Hogs-beef cattle	68	0.2490	0.1137

* The coefficient chosen was a linear one. Scatter diagrams suggested that the relationship was appropriate.

The mode of the corn-hog ratio expected by farmers interviewed lay in the range 12.00 to 12.99. The mode of the expected corn-beef cattle ratio was in the 25.00 to 25.99 range.

Questions were designed to ascertain the attitude of the farmers towards a forward sale contract for corn. The answers indicated a strong desire on the part of the farmer to retain control of the use of the corn rather than to contract in advance for its sale. The contract proposed was one in which the farmer was asked to state the lowest price per bushel at which he would agree, at the time of the survey (March-April 1950), to contract to sell that part of

his 1950 corn crop which he intended to sell or seal under government loan. No obligation to deliver a specified number of bushels was to be incurred, but instead an agreement to sell all corn grown on a specified acreage was to be made.

Sufficient information was obtained from 123 of the 161 farmers to enable an estimate of the uncertainty premium for each farmer to be calculated.[1] To estimate the uncertainty premium the contract price was compared with the expected market price or expected government support price, whichever was higher.[2] Adjustments of expected corn prices in Chicago were made in order to be able to express them as prices on the farm, and a deduction was made for the costs of sealing under the government support program. When these adjustments were made, it was found that farmers were unwilling to contract to sell their corn in advance except at prices above the most probable single price which they expected in December 1950. In some cases the price necessary to induce the farmer to sign the contract was above the upper limit of the *range* of prices expected by the farmer.

Records were also secured of reactions of farmers to a series of questions presenting alternatives between a sure or certain specified income on the one hand and an uncertain alternative on the other. The uncertain alternative was such that it may have yielded 50 per cent more or 50 per cent less income than the "sure" income depending on the outcome of the uncertain venture. The questions referred to hypothetical situations at both high and low income levels, so that an analysis of changes of choice by farmers between high and low income situations could be made. Finally, an attempt was made to establish associations between the attitudes of farmers toward uncertainty as measured by their answers to these questions and the economic experience and social factors attributable to each farmer.

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[1] Sixteen of the farmers not included in this analysis refused to contract at the time of the survey to sell the corn they intended to grow in 1950; the remainder of the farmers did not provide enough other information to enable the uncertainty premium to be estimated.

[2] Four of the 161 farmers stated their expected price to be in excess of the support price at which they expected government loans on the 1950 crop to be made.

These sure-chance questions were introduced into the questionnaire in an effort to ascertain whether they could be used as a measure of the attitude of different farmers toward risk and uncertainty. The questions together with the numbers of farmers answering the alternative in each case were:

If you were on a radio giveaway show and had the chance to (a) take $1,000, or (b) take $500 or $1,500, depending on the toss of a coin, what would you do?

(127) take the $1,000 and be sure of it
(33) take the chance of either $1,500 or $500.[3]

What if the result depended not on the toss of a coin but on your answer to a question about corn-belt farming?

(86) would take the $1,000 and be sure of it
(75) would take a chance on the $500 or $1,500.

What if the same position applied to profit on one of your farm enterprises, such as corn storage, or selling; or selling cattle or keeping them for a little longer?

(95) would prefer to be sure of the $1,000 profit
(66) would take a chance on the $1,500 or the $500 profit.

What if you had the choice of two farm plans, so that the profit would be for the whole farm, not one part of it. Would you prefer to be sure of $5,000 or would you try another plan in which you might get $7,500 or $2,500?

(123) would prefer to be sure of the $5,000
(38) would prefer to take a chance on the $7,500 or $2,500.

What if the two plans were for small amounts, but still applied to the whole farm plan?

(111) would prefer to be sure of $2,000
(50) would prefer to take a chance on getting $1,000 or $3,000.

These results present the total response by the 161 farmers. The total changes from one question to another are *net* as some farmers changed their choices in an opposite manner to the majority in moving from question to question.

When farmers are classified in some farm management analyses, there is an implicit assumption that any factor not used in the classification has a random incidence on all the farm classes established, until tests of significant associations suggest otherwise. Such

[3] One farmer was unable to answer this question as he could not imagine himself in such a situation. His reply to the other four choices was "sure" in each case.

analyses assume that the effect of these factors can be ignored and differences between the groups may be attributed to those variables used to establish the classes of farms. Part of the analysis in this survey was devoted to a study to determine whether the farmer's attitude towards uncertainty is associated with one or another of the factors, such as tenure status or size of farm business, which are commonly used to classify farms. If such associations exist, then some of the results previously attributed to these factors may be in part a result of the associated differences relating to uncertainty which also exist between the groups of farms.

If the assumption is granted that the answers to the questions asked do provide a basis for classifying farmers according to their uncertainty preference, then it has been shown that the year in which the farmer started farming, the levels of expected prices compared with other farmers, the farmer's age and education and his tenure status are all associated with differences in attitudes toward those aspects of uncertainty in relation to which questions were asked. This conclusion is based on the use of the chi square test, and the results stated are those significant at the five per cent level of significance.

The historical, analytical and empirical methods have each served their respective purpose. They have led to the development of an argument which suggests the usefulness of dynamic economics in the interpretation of farm management situations. The position and attitude of the farmer relative to uncertainty may well limit his ability to follow the example of the farmer known to have earned the highest income in past time periods. By concentrating attention on this aspect of the farmer's problems, a more realistic or practical recommendation can be made based on the experiences of others and the particular circumstances of the farmer under consideration.

May 30, 1950.

VITA

Donald Birtall Williams was born on October 14, 1920, in Orange, New South Wales, Australia. After matriculating from Hurlstone Agricultural High School and being awarded a Public Exhibition and a State Bursary he entered the University of Sydney in 1938. He completed requirements for the degree of Bachelor of Science in Agriculture at that university in December 1941, when he enlisted in the Australian Military Forces. In August 1942, he was released to undertake duties in the Commonwealth Department of War Organization of Industry. In 1943 he transferred to the Commonwealth Directorate of Agriculture in the Department of Commerce and Agriculture. During 1943-46, he studied part time at the Melbourne University and graduated from that institution with the degree of Bachelor of Commerce in April 1947. In January 1946, he was appointed Rural Economist at Roseworthy Agricultural College, South Australia and also held a part time lecturing appointment in the Department of Economics at the Adelaide University during the years 1947-48. On April 20, 1946 he married Claire Fielding of Rainbow Victoria, at Malvern Victoria.

He remained at Roseworthy College until July 1948 when he was awarded the Thomas Lawrance Pawlett Scholarship by the University of Sydney and a Charles H. Booth Fellowship at the University of Illinois. He entered the Graduate College at the University of Illinois in September 1948, and has held the scholarships mentioned during the academic years 1948-49 and 1949-50. He received the degree of Master of Science in Agricultural Economics at the University of Illinois in June 1949. He is a member of Gamma Sigma Delta, Phi Kappa Phi and Sigma Xi honor societies.